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of affiliation between philosophy and psychology historically, and emphasized the necessity of a close relationship between them, both as to the central issues of the problem of "the soul" and as to the methodological phases of the two lines of endeavor. Professor Ladd insisted that psychology may properly become affiliated with all the sciences which can throw any light upon the problems of consciousness, while at the same time it forms the best possible scientific introduction to philosophy. These affiliations, however, do not involve any necessarily consequent relinquishment of independence on the part of psychology. The current discrediting of psychology is but a passing phase of scientific criticism.

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REVIEWS AND ABSTRACTS OF LITERATURE

The Science and Philosophy of the Organism. HANS DRIESCH. New York: The Macmillan Co. 1908. Pp. xiii + 329.

"I should like to be as careful as possible in the admission of anything like a 'proof' of vitalism. It was want of scientific criticism and rigid logic that discredited the old vitalism; we must render our work as difficult as possible to ourselves, we must hold the so-called 'machine theory' of life as long as possible, we must hold it until we are really forced to give it up." Hans Driesch.

Those who have followed in recent years the reaction against the materialistic and mechanical interpretations of biological phenomena are familiar with the work of Hans Driesch. An invitation to deliver the Gifford Lectures at Aberdeen has furnished Driesch with the opportunity of bringing before a more general audience the conclusions to which his analysis of living phenomena have led. The first volume of these lectures (in English) has just appeared under the title of "The Science and Philosophy of the Organism." The second volume is soon to follow.

Few, if any, zoologists of modern times could bring to the task the many-sided abilities of the author of this volume. Trained in the most modern school of zoology, widely read and interested in philosophy and mathematics, possessed of an analytical mind of rare clearness, frankness, and insight, Driesch has compelled once more the attention of thinking men to the famous doctrine of vitalism.

That Driesch has written a fascinating exposition of his subject few will deny—provided they have not become too callous to consider any other interpretation possible than the current dogmatic materialism. Our purpose is to present Driesch's argument for vitalism and to examine critically the question of the validity of the evidence offered as a *proof* of the doctrine.

Driesch replies to those who maintain that "there are no fundamental principles in biology which would bring it in any close contact with philosophy" that it will be his endeavor "to convince you that such an aspect of the science of biology is wrong; that biology is an elemental natural science in the true sense of the word. But if biology is an elemental science then, and only then, it stands in close relations to epistemology and ontology. . . ."

"Life is unknown to us except in association with bodies." "There are three features which are never wanting wherever life in bodies occurs. All living bodies are specific in form . . . all living bodies exhibit metabolism . . . all living bodies move." "It is *form* in particular which can be said to occupy the very center of biological interest, at least it furnishes the foundation of all biology." These statements are significant inasmuch as the proof of vitalism is found in Driesch's analysis in the study of form. It will no doubt strike the casual reader as strange that Driesch seeks his proof in form rather than in the psychic phenomena of the living world. It may be that the apparently simpler conditions surrounding form-production have led him to look here rather than elsewhere for the rigorous proof he seeks.

The first proof of vitalism is found in the relations of the parts of the segmented egg to one another. The results of experimental embryology have shown that the fate of each region of the blastoderm is intimately connected with its relation to other parts; "the fate of a part is a function of its position." Each part has potentially—for a time at least—the property of becoming any part of the whole, its location determines its development.

Driesch argues that the factors that determine the fate of each part can not come from without, nor can they come from the interaction of the parts. Therefore some other factor must be invoked to account for the localization of the organs of the embryo. Driesch thinks that while polarity and bilaterality—the main directors of the intimate protoplasmic structure—are given, their interaction could not be responsible for the manifoldness of development. He also believes that chemically different compounds existing in the egg can not account for development, because the form of elementary organs does not go hand in hand with chemical differences, and can not, therefore, depend on them. But since we know very little of the chemical composition of the substances of the egg, it seems to the reviewer that Driesch's argument would be less open to objection had he rested it on the well-known fact that a part already demonstrably specialized can, if severed from the rest, make a new whole, as when the foot end of hydra is cut off and quickly produces a new hydra.

If it is granted, then, that neither external factors nor the presence of chemically different substances in the egg accounts for development, can we explain the process as the result of a complicated machine-like structure preexisting in the egg? This is disproven, Driesch thinks, by the fact that if parts of the segmenting egg are taken away, the remaining parts, as well as those removed, will each produce new wholes. No machine is capable of behavior of this kind!

Since mechanical and chemical explanations fail, it follows that the developmental process must be autonomous. This autonomous factor Driesch calls "entelechy." He states that he will use this term only as a sign of admiration for Aristotle's great genius; "his word is a mould which we have filled and shall fill with new contents."

It will be seen that Driesch's proof rests on a process of exclusion. It fails unless all possibilities of mechanical explanation have been exhausted. To many thinkers the proof will amount only to a demonstration that at present we are ignorant of the factors that determine the formative changes in the developing embryo; but Driesch thinks that his analysis has entirely excluded the possibility of mechanical interpretation.

In this connection it is not without interest to call to mind Lehmann's recent important discoveries concerning fluid crystals. He has shown that a number of organic compounds—some of them, be it noted, known to exist in the living body—assume definite crystalline forms which can be accounted for on purely physical grounds. These crystals can take new matter into themselves and grow accordingly. If a part is removed, it promptly assumes the same form as the original whole. Here we have a machine, any part of it capable of changing into the form of the original whole. It need not be argued from this that the organism is a fluid crystal, although we think not a bad "case" might be made out in favor of this view—nor need we attempt to prove that the formative processes are the same for the fluid crystal and for the living body; but the example suffices to show that there do exist machines of which any given part can reproduce the whole form.

The second proof of vitalism is derived from the power of every individual to produce eggs capable of reproducing the parent organism—a fact so familiar that its use as a proof of vitalism comes as a surprise. Driesch argues that our inability to think of this process as one on the engine-pattern proves the autonomy of the process. But why so? If, as we have seen, a piece of a fluid crystal reproduces a new whole, why may not an egg which is only a piece of an animal arising by cell-division? A difficulty might arise in explaining how the egg divides; but cell-division is not itself put down as evidence of vitalism. To the zoologist the property of the organism to produce eggs appears in the same light as do all other cell-divisions. If the continuity of material (germ-plasm) be admitted, there is no special problem found here; what Driesch means is that since the germ material has taken part already in one development—forming as it does a constituent part of the early embryo—it is inconceivable on a mechanical basis that it could return once more to the starting-point. In part this property is something more than the ability shown by pieces of the embryo or adult to reproduce the whole, since the egg returns to the starting-point while the pieces press on to their goal without going through the early stages again. It will be admitted, we think, that here Driesch puts his finger on one of the most subtle biological phenomena. The difficulty of picturing to oneself how the return can be explained will be admitted by all thinking men.

Those who seek consolation in the idea of the continuity of the germ-plasm—meaning thereby that a stream of undifferentiated material is passed on from one generation to the next—ignore the well-known fact that in most cases all the cells take part in the early development. If it be argued that, although present in the embryonic organs, the germ-material is carried passively along—for which view there is little or no evidence—the fact that differentiated cells that have functioned as parts of the body may likewise return to the embryonic condition and pass through the development will sufficiently cover the case. How serious this difficulty may prove the future must decide.

Driesch's conception of the relation between entelechy and the material through which or by means of which it acts is well brought out in the following statement: "But what about the material continuity appearing in inheritance, which we have said to be almost self-evident, as life is only known to exist in material bodies? Is there not, in fact, a serious contradiction in admitting at the same time entelechy on the one side and a sort of material condition on the other as the basis of all that leads to and from inheritance?" He promises in the second volume to go further into the question; "At present it must be enough to state in a more simple and realistic way what we hold this relation to be. There is no contradiction at all in stating that material continuity is the basis of inheritance on the one side, and entelechy on the other." Both are at work at the same time. "Entelechy, at present, is not much more for us than a mere word, to signify the autonomous, the irreducible of all that happens in morphogenesis with respect to order in the one generation and in the next. But may not the material continuity which exists in inheritance account, perhaps, for the material elements which are to be ordered? In such a way, indeed, I hope we shall be able to reconcile entelechy and the material basis of heredity." The first part of this statement shows that Driesch is not as dogmatic in his advocacy of vitalism as some of his critics would lead us to believe. No serious objection is likely to be raised if one calls autonomous all that is at present irreducible in morphogenesis. On the other hand the attempt to treat the entelechy as something apart from and yet controlling the material basis will seem to most readers, we fear, to come perilously near to mysticism. One satisfying fact emerges from this discussion, namely, that we can, at will, divide the entelechy with a knife by cutting the egg in two, and produce two new entire entelechies thereby. It seems altogether delightful to be able to divide entelechy by so simple a means, but one may doubt whether the problem is simplified when entelechy as well as material is involved in the results.

A serious difficulty to Driesch's view may be found in the production of galls on plants—a difficulty dismissed by Driesch on insufficient grounds, it seems to us. As the result of the presence of a parasitic insect on or in the forming leaf, a complete morphological structure—a gall—is produced. Some of these galls show remarkable adaptations for the benefit of the parasite (but not for the plant) that produces the gall. At the time when the inhabitants of the gall are ready to emerge the gall opens and sets them free. Now we ask in all seriousness, whence has come the entelechy in the gall? Does the plant contain the entelechy to produce adaptive structures whose presence is injurious to the plant, or does the activity of the enclosed insects introduce a new sort of entelechy into the plant? Obviously it would be advantageous to the plant never to set free the gall's contents, for thereby it would rid itself of its parasites forever.

Whether we agree with Driesch or not concerning the nature of the unknown factors of development, his attempt to hold our interpretation to the more difficult epigenetic lines of thought is, we think, deserving of the highest praise. Choosing the more difficult path, we at least keep open the way for further work and thought.

We have selected for comment that portion of Driesch's book that will, we believe, excite the greatest interest. But the book is enriched by excursions into many other fields more or less related to the main theme here discussed. The treatment of such matters as heredity, descent, adaptation, Lamarckism, the logic of history, etc., contains much original and independent thought. The handling of these matters will be found stimulating and suggestive. The second volume, in which a discussion of the more abstruse matters touched on in the present volume is promised, will be awaited with interest.

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Abriss der Psychologie.[1] H. EBBINGHAUS. Leipzig: Veit und Comp. 1908. Pp. iv + 196.

This book is the original draft, slightly enlarged, of the contribution of Professor Ebbinghaus to Hinneberg's "Kultur der Gegenwart." It is introduced by an admirable sketch (pp. 1–17) of the history of psychology. "Psychology," Ebbinghaus points out, "has a long past, yet only a short history"; and with much discrimination, he indicates the obstacles in the path of the development of a science of psychology, the conditions of the growth of psychology, and the characteristic contributions of the great makers of modern psychology. His references to Spinoza, Hobbes, Hume, Herbart, and the physiologists and physicists of the earlier nineteenth century are especially suggestive.

Following upon this historical chapter comes the first division of the book, a discussion of "Allgemeine Anschauungen." This contains a brief but admirable summary of the physiology of the nervous system and a clear restatement of the doctrine, embodied in Ebbinghaus's "Grundzüge," of Spinozistic psychophysical parallelism. "Soul and nervous system," he declares (p. 39), "are not two separated, interacting [realities] . . . they are one and the same real, on the one hand as it immediately knows itself and is for itself, on the other hand as it exhibits itself to other similar reals when it is experienced by them—seen or touched by them, as we say." This familiar doctrine is based upon a very unconvincing argument. Like so many parallelists, Ebbinghaus assumes

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[1] A translation by Professor Max Meyer is announced by D. C. Heath, Boston.